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# Enhancing the Intelligence Analysis Capabilities of the Intelligence S&T Integration Platform

*Architecture Report for the visualization services*

Daniel Bart  
DMR Conseil

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**Defence Research and Development Canada – Valcartier**

Contract Report  
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# **Enhancing the Intelligence Analysis Capabilities of the Intelligence S&T Integration Platform**

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## **Abstract**

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This document presents the Software Architecture Description according to the IEEE 12207. Its purpose is to define a list of requirements for the visualization services of Spatial Feature visualization and Facts extracted from the Automated Fact Extraction from Text Documents visualization, and to evaluate open source visualization components available on the web to fulfill the requirements in the new infrastructure developed within the TA-69 and named Widget Application Shell.

## **Résumé**

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Le document présente la description de l'architecture logicielle, conformément à la norme IEEE 12207. Il vise d'une part à dresser la liste des exigences visant les services de visualisation des faits et caractéristiques spatiales provenant de l'extraction automatique des faits d'une visualisation de documents textuels, et d'autre part à évaluer les modules de visualisation de source ouverte disponibles en ligne afin de répondre aux besoins de la nouvelle infrastructure créée dans le cadre de l'AT-69, qu'on appelle l'espace de travail du générateur de widgets (Widget Application Shell).

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***Enhancing the Intelligence Analysis Capabilities of  
the Intelligence S&T Integration Platform***

**Architecture Report for the visualization services**

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## **1. About this Document**

This document presents the Software Architecture Description (SAD) according to the IEEE 12207.

### **Purpose**

- To define a list of requirements for the visualization services of Spatial Feature visualization and Facts extracted from the AFEXTD visualization.
- To evaluate open source visualization components available on the web to fulfill the requirements in the new infrastructure developed within the TA-69 and named Widget Application Shell (WAS).

## 2. Analysis of the visualization capability

### 2.1 Spatial Features visualization

#### Overview

The spatial features visualization should have the following capabilities:

- Enable the creation, edition, deletion of overall analysis zones and of individual spatial features.
- Enable the definition/specification of the attributes of zones and features.
- Enable the manipulation of multiple spatial features as a group.

#### Requirements list

- Creation/Edition/Deletion of spatial features
  - Polygons (point-to-point)
  - Lines and polylines
  - Single Point
  - Rectangles and squares
  - Ellipses and circles
  - Pie slice and Swath
  - Triangle
- Definition/Specification of attributes of zones and features
- Ability to select spatial feature
- Lasso selection tool
- Spatial features Grouping (set)

#### Analysis results

GWT-OpenLayers offers the best API to develop our spatial features visualizations. Even if there's no creation/edition/deletion for all spatial features, developing it using a drawing API should be a good approach. There's already an example of rectangle drawing on the OpenLayers website that will help us for the development of all features.

### 2.2 AFEXTD (Automated Fact Extraction from Text Documents) visualization

#### Overview

The automated fact extraction from text documents should have the capability of:

- Enable the configuration of the new service(s) and control its execution.
- Enable the visualization of the service's output results.

### **Requirements list**

- Upload document
- List facts extracted
- Display facts on map

### **Analysis results**

By using a GWT based platform, most of the needed features will be built-in (lists, file upload). Only specific (or applicative) renderer will have to be developed. The part that is more risky is to display the facts on a map, which is a little more complex UI challenge. There are open source libraries for that part but they are less documented and community of developers active on internet is smaller than for the other libraries. GWT-OpenLayers seems to be the best library to use for displaying facts on a map.

### 3. Evaluation of Open Source solutions

#### 3.1 Google Web Toolkit (GWT)

##### Description

Google Web Toolkit (GWT) is a development toolkit for building and optimizing complex browser-based applications. GWT is used in many Google products, including Google AdWords and Orkut. It's open source, completely free, and used by thousands of developers around the world.

##### Other information

Version: 2.1

References: <http://code.google.com/webtoolkit/>

##### 3.1.1 Evaluation

<b>Supported Technologies</b>	Development in Java. It generates AJAX applications.
<b>Features</b>	<ul style="list-style-type: none"> <li>• All basic input components (Checkbox, Text input, etc.)</li> <li>• List, Tree view</li> <li>• Menu bar</li> <li>• Many layout panels to define complex layout</li> <li>• Table, Cell list, Cell Table, Cell tree</li> <li>• Internationalization (I18N) features</li> <li>• Event handling architecture (for notification between widgets)</li> </ul> <p>See <a href="http://gwt.google.com/samples/Showcase/">http://gwt.google.com/samples/Showcase/</a> for complete list of features.</p>
<b>Pros</b>	<ul style="list-style-type: none"> <li>• Developer community is growing up and framework is still evolving.</li> <li>• Open source libraries available to enhance features list</li> <li>• Java-based development.</li> <li>• Allows embedding any technologies that could run in a web browser. Important if we want to use an open source visualization component developed in other technology such as Flash or AJAX.</li> <li>• Easier communication with back-end.</li> </ul>
<b>Cons</b>	<ul style="list-style-type: none"> <li>• Embedding other technology may be more complex for coordination between widgets.</li> </ul>
<b>Overall score</b>	4 out of 5

### 3.1.2 Recommendations

According to the needs described in the ramp-up meeting with the SA, GWT is a very good option to develop the application framework. Unlike Flex, GWT will allow embedding other technology such as Flash/Flex. It also covers good parts of our needs for the framework.

## 3.2 Smart GWT

### Description

Smart GWT is a GWT-based framework that allows you to not only utilize its comprehensive widget library for your application UI, but also tie these widgets in with your server-side for data management.

### Other information

Version: 2.4

License: GNU LPGL (<http://www.gnu.org/licenses/lgpl.html>)

References: <http://code.google.com/p/smartgwt/>

### 3.2.1 Evaluation table

<b>Supported Technologies</b>	GWT 1.5.3, GWT 1.6.4, GWT 1.7.x and GWT 2.x
<b>Features</b>	<ul style="list-style-type: none"> <li>• Grids, Trees, Tiles</li> <li>• Layouts, Windows, Sections, Tabs</li> <li>• Forms, Form controls</li> <li>• Buttons, Menus &amp; Dialogs</li> <li>• Calendar</li> <li>• Filtering &amp; sorting of datasets</li> <li>• Drag and Drop</li> <li>• DataSources &amp; Data binding</li> <li>• Client-side validation</li> <li>• REST / WSDL support</li> <li>• Skinning / Branding</li> <li>• Printing support</li> </ul>
<b>Pros</b>	<ul style="list-style-type: none"> <li>• Huge amount of features</li> <li>• GWT compatible</li> </ul>
<b>Cons</b>	<ul style="list-style-type: none"> <li>• Performance unknown</li> </ul>
<b>Overall score</b>	4.5 out of 5

### 3.2.2 Recommendations

The smart GWT framework offers a large library of components and it could be a nice add-on to GWT. Some features would allow creating applications quickly and using widgets such as lists, trees, etc.

### 3.3 GWT-OpenLayers

#### Description

GWT-OpenLayers is a Java wrapper for the OpenLayers JavaScript API. It allows GWT projects to use the OpenLayers JavaScript API. OpenLayers makes it easy to put a dynamic map in any web page. It can display map tiles and markers loaded from any source. OpenLayers has been developed to further the use of geographic information of all kinds. OpenLayers is completely free.

#### Other information

Version: 0.5

License: [modified BSD license](#)

References: <http://gwt-openlayers.sourceforge.net> , <http://openlayers.org>

#### 3.3.1 Evaluation table

<b>Supported Technologies</b>	GWT, Java, Javascript, AJAX
<b>Features</b>	<ul style="list-style-type: none"> <li>• WMS Layers</li> <li>• Navigation</li> <li>• Icons</li> <li>• Markers</li> <li>• Layer Selection</li> </ul>
<b>Pros</b>	<ul style="list-style-type: none"> <li>• GWT integrated</li> <li>• Many examples available (<a href="http://openlayers.org/dev/examples/">http://openlayers.org/dev/examples/</a>)</li> </ul>
<b>Cons</b>	<ul style="list-style-type: none"> <li>• Mouse capture may be a little more complex to manage than a Flex/Flash version.</li> <li>• 2D only</li> </ul>
<b>Overall score</b>	3.5 out of 5

#### 3.3.2 Recommendations

Even if 3D is not available, OpenLayers seems to be the most advanced map control on the open source market at this time. Its integration to GWT will make it easier to use in our framework and applications. An interesting test case for the GWT-OpenLayers would be to use and test this technology to visualize a selected and modeled subset of tracks extracted from the GPWTracks database available from the ISTIP.

### 3.4 GWT Mosaic

#### Description

GWT Mosaic is a feature rich toolkit for creating graphical Rich Internet Applications. Offering a complete set of widgets, GWT Mosaic is suitable for projects ranging from small one-off projects to complete application suites.

The goal is to provide a complete widget set by keeping the API as close as possible to the GWT's standard widgets API.

### Other information

Version: 0.4.0

License: Apache License 2.0

References: <http://code.google.com/p/gwt-mosaic/>

### 3.4.1 Evaluation table

<b>Supported Technologies</b>	GWT 2.0.1, Java, Javascript, AJAX
<b>Features</b>	<ul style="list-style-type: none"> <li>• Basic form controls (button, inputs, etc.)</li> <li>• Popups</li> <li>• Windows</li> <li>• Layouts</li> <li>• Tree, List</li> <li>• Drag &amp; Drop</li> <li>• Beans Binding</li> </ul> <p>See a showcase at <a href="http://mosaic.analytical-labs.com">http://mosaic.analytical-labs.com</a></p>
<b>Pros</b>	<ul style="list-style-type: none"> <li>• Good set of features</li> </ul>
<b>Cons</b>	<ul style="list-style-type: none"> <li>• Decreasing development activity</li> <li>• GWT 2.0 (not 2.1)</li> </ul>
<b>Overall score</b>	3 out of 5

### 3.4.2 Recommendations

Having analyzed Smart GWT before, I don't think GWT-Mosaic has any features that Smart GWT doesn't offer. The decreasing activity in development let me think that future versions of GWT could be hard to maintain within GWT-Mosaic. I clearly prefer Smart GWT.

## 3.5 Synapse Application Framework

### Description

Synapse is a thin client application SDK based on the Ozone Widget Framework (OWF), a framework for hosting widgets (lightweight software components) in Web browsers.

### Other information

Version: 2.1.4

License: GNU GPL

References: <http://www.potomacfusion.com/capabilities/synapse/>

### 3.5.1 Evaluation table

<b>Supported Technologies</b>	Apache Shindig
<b>Features</b>	<ul style="list-style-type: none"> <li>• publish/subscribe messaging system</li> <li>• Based on Ozone Widget Framework</li> </ul>
<b>Pros</b>	<ul style="list-style-type: none"> <li>• Built-in messaging system</li> </ul>



<b>Cons</b>	<ul style="list-style-type: none"><li>• Base on Apache Shindig</li><li>• Real lack of documentation and information</li><li>• Community of developers</li></ul>
<b>Overall score</b>	2 out of 5

### 3.5.2 Recommendations

Due to the lack of information on the product, and to the fact that it is running on Apache Shinding, I do not recommend the use this framework.

## 4. Evaluation of Implementation efforts

The table below shows estimated efforts (in days) that could be needed to demonstrate the functionality / feature in a demo application. Note that some of the features need more time due to unavailability of open source currently. These efforts are estimate and there are risks of incompatibility when we use many libraries together. Priority column shows a priority based on a range of 1 to 5.

Features	Effort	Priority
<b>Creation/Edition/Deletion of spatial features</b>		
<b>Polygons (point-to-point), Triangle</b>	1	1
<b>Lines and polylines</b>	1	1
<b>Single Point</b>	1	1
<b>Rectangles and squares</b>	1	3
<b>Ellipses and circles</b>	2	3
<b>Pie slice and Swath</b>	3	4
<b>Spatial features Visualization</b>		
<b>Definition/Specification of attributes of spatial features</b>	10	2
<b>Ability to select spatial feature</b>	1.5	2
<b>Lasso selection tool</b>	1	3
<b>Spatial features Grouping (set)</b>	1.5	2
<b>AFEXTD Visualization</b>		
<b>Ontologies classes and instances selector</b>	15	2
<b>Facts edition component</b>		
<b>Fact definition selection</b>	3	3
<b>Display editable fact</b>	5	3
<b>Create processing context (configuration)</b>		
<b>Text patterns creation</b>		
<b>String/Regex Editor</b>	0.5	3
<b>Lexical category token editor</b>	0.5	3
<b>Ontologies classes and instances selection</b>	0.5	3
<b>Group editor</b>	0.5	3
<b>Tokens Drag &amp; Drop in groups</b>	5	3
<b>Group tokens drag &amp; drop in facts arguments</b>	3	3
<b>Upload document</b>	1	1
<b>Show requests statuses in list</b>	2	1

<b>Show extracted facts</b>		
<b>List facts extracted</b>	2	2
<b>Display facts on map</b>	5	3
<b>Display facts details</b>	3	3
<b>Display facts in timeline</b>	2	3

## **5. Summary**

According to the analysis, using GWT in collaboration with smart GWT and GWT Open Layers, we should be able to develop most of the features desired. Some spatial features drawing will be a little more complex and should take more time to develop (i.e.: Pie slice, swath). For the AFEXTD part, the biggest challenge will be to display facts on a map. Open source libraries will definitely accelerate development of these features but it may add some risks of incompatibility between them. Estimates in this document do not include the kind of risks that could force us to abandon a library.

## **6. Glossary of Acronyms**

AFEXTD - Automated Fact Extraction from Text Documents  
AJAX - Asynchronous JavaScript and XML  
API - Application programming interface  
GPW - Global Positioning Warehouse  
GPWTV - GPW Tracks Visualization  
GWT - Google Web Toolkit  
I18N - Internationalization  
ISTIP - Intelligence Science & Technology Integration Platform  
SA - Scientific Authority  
SDK - Software development kit  
SVG - Scalable Vector Graphics  
UI - User Interface  
WAS - Widget Application Shell  
WMS - Web Map Service

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software architecture description; visualization; spatial features





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